

Immersion in science – off the grid in the Amazon

Description



Last month I spent a week in the Amazon surrounded by gigantic lush green trees and the constant, noisy accompaniment of jungle creatures, writes Chantelle Burton – a Climate Scientist at the Met Office's Hadley Centre.

I was lucky enough to participate in the 'Amazonia and Climate Change Field Course', hosted by National Institute of Amazonian Research (INPA), the Inter-American Development Bank (IDB), and the Brazilian Ministry of Science, Technology and Innovation. Places on the trip were limited to 15 masters or PhD students, including 10 from Latin-America and five from the rest of the world.

Jungle home

On arrival, we set up home in a field station at the Cuieiras Biological Reserve, owned by INPA, 100km north of Manaus. Saying it was situated in the heart of the rainforest is no overstatement; we were a 90-



objective of the week-long field trip was introducing methods for assessing the impacts of climate change on the Amazon forest, combining modelling and observations. Based at the site of the [AmazonFACE](#) project, a central theme was exploring how tropical forests may respond to climate change, specifically high levels of carbon dioxide. As my PhD topic is 'Climate and land-use change effects on fire in the Amazon', this was well-aligned with my research. My work is supported by the [Newton Fund Climate Science for Service Partnership Brazil](#) – a partnership between the Met Office, INPA, the *Brazilian* Institute of Space Research (INPE) and CEMADEN, so this was also an opportunity for me to create stronger links with our partner organisations.

Observations and measurements

The programme for the week was divided into three main themes:

- ecosystem processes (photosynthesis and gas exchange in leaves),
- above-ground measurements (biomass of trees), and
- below-ground processes (soil functions and root growth).

We started our observations by visiting the 50-metre LBA tower near the field station that is used to collect climatological observations. The extreme humidity, high heat and copious amounts of insect repellent made even this short 20-minute walk difficult; we were all soaked in sweat within minutes and were grateful for the availability of cold showers when we returned to the field station!



Biomass measurements: Sophie uses a laser to measure the height of the trees, while I measure the diameter with a diameter tape and electronic calliper. This is

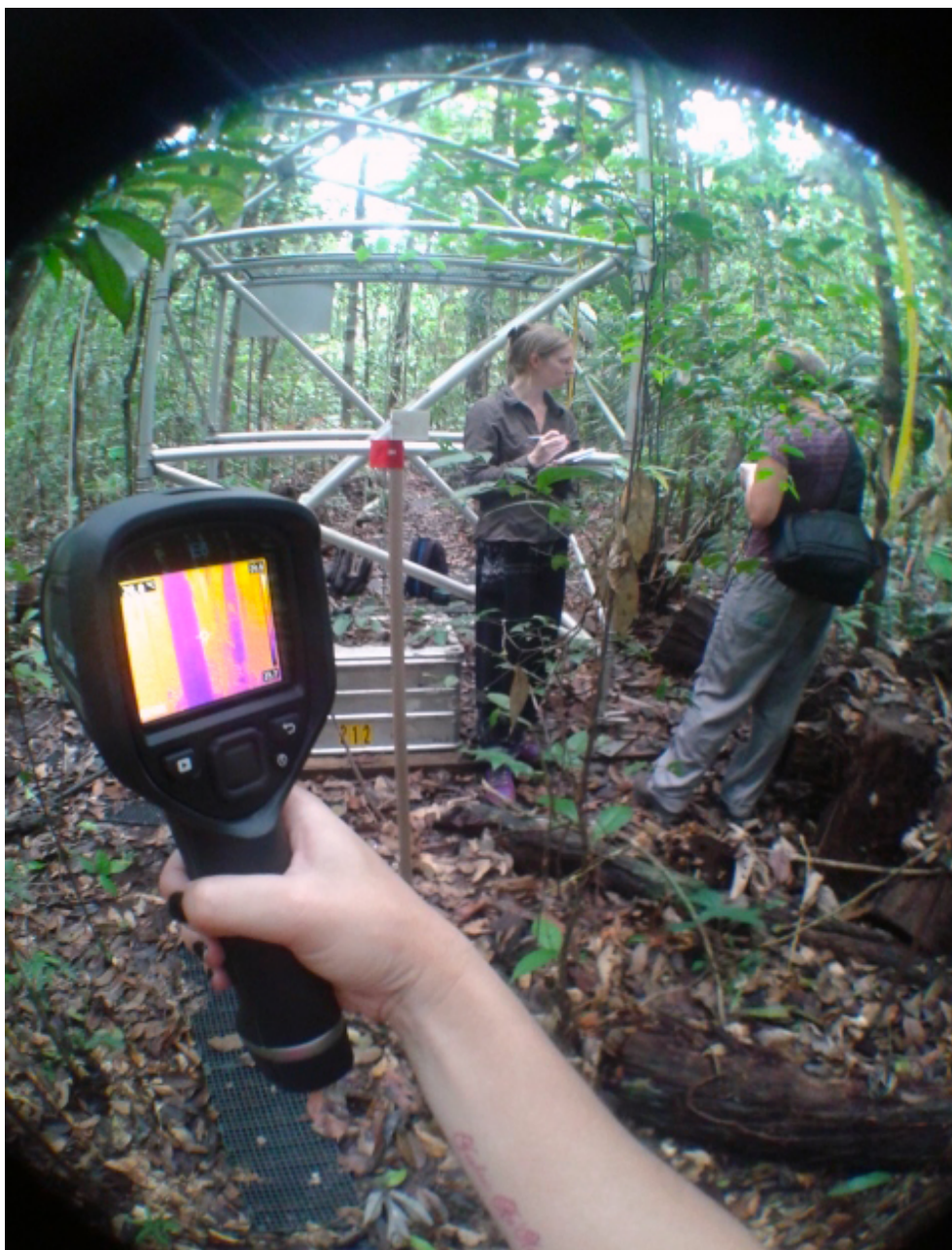
usually done at 1.4m, unless there is an irregularity in the tree at this height, when measurements are taken 50cm higher

Each morning we collected data, with methods ranging from the latest high-tech instruments for measuring rates of photosynthesis, to sifting through soil cores for roots, to measuring the diameter of trees with an electronic calliper and a tape measure. As there were often heavy tropical downpours in the afternoon, we spent this time logging the data and analysing it to answer questions such as 'how does the rate of photosynthesis change with increasing CO₂?', and 'how might nutrient limitation affect plant growth?'.

Experiencing the ecosystem

On the last day we had an introduction to 'LPJ-GUESS', a model used to represent changes in vegetation, and discussed how the observations we had been collecting over the week are represented in models and what assumptions are made in the process. For example, there are around 16,000 tree species in the Amazon, and this is currently represented as just one type of tree in models. It highlighted just how important it is for observations and modelling communities to work together to improve understanding.

In my day-to-day work it is very easy to feel removed from the ecosystem that I am studying. Running models and creating 2D maps or graphs of large-scale vegetation patterns from a cold, clean office in the UK is completely different to studying the individual living processes of the hot, humid, dense Amazon, with its enormous variety of species, wildlife, and complex web of interconnected functions that keep this system stable. The primary aims of the course were knowledge exchange and furthering scientific understanding of this ecosystem. Through the passionate interaction between students, post-doctorates and lecturers, it was easy to see the successful fulfilment of this throughout the week.



Ecosystem processes: Fernanda takes temperature readings of the vegetation using an Electronic Thermal imaging camera (FLIR), while Sophie uses a leaf porometer to measure stomatal conductance, and I record the readings. A fish eye lens is used to take photos of the canopy to measure gap fraction and light levels.

For me, bringing together two communities that commonly work on the same topic but rarely interact is essential if we are to improve our joint understanding of critical ecosystems such as the Amazon, and contribute to maintaining its resilience. This was a fantastic opportunity for me both on a scientific and personal level to experience the “real Amazon”, a definite once-in-a-lifetime experience, and I’m very grateful to the course organisers and my sponsors for supporting my participation.

Date Created

November 2016

What does this winter have in store?

Description

Long-range predictions have given good [indications of global average temperature](#) so far this year. 2016 is running at record levels of global warmth, as predicted. However, these global figures don't necessarily mean the UK will be warm. It's never as simple as taking global information and applying it to a UK regional scale.

So, what are the latest indications for the [coming winter](#)? Professor Adam Scaife, head of long-range prediction at the Met Office Hadley Centre, explains: "The risk of a cold start to winter has increased to 30% this year. Statistically, however, it is still more likely that the UK will experience a normal start to winter, but there is an increased risk of cold snaps between now and Christmas."

Adam added: "Several factors, including tropical rainfall, are known to drive UK and European winter conditions: following a strong [El Niño](#) last year, the tropics are now influenced by a weak La Niña and unusual rainfall conditions in the Indian Ocean."

However, prospects for winter in the UK aren't governed solely by tropical rainfall, there are other influences too. For example, the [Quasi-Biennial Oscillation](#) (QBO) experienced an [unprecedented flip in February](#) and is now back to westerlies this year. And although it is not the main factor, the westerly phase of the QBO is associated with milder wetter winters. Finally, the winds high in the stratosphere, circling the Arctic – around what is known as the Polar Vortex – are disturbed and weak at the moment. Although these winds are many kilometres above the surface, they can influence the strength and position of the jet stream, and this is helping to increase the risk of cold snaps in the UK.

Adam added: "Historical weather observations and our latest computer model simulations agree that these factors are increasing the risk of a cold start to winter for the UK, but this is unlikely to persist through winter as a whole."

The record of recent winter outlooks has been encouraging, and the Met Office outlook has given good advice in recent winters for the UK as a whole. For example, last winter the mild wet stormy December and drier, cooler end to winter was picked up more than a month ahead.

It is too early to make definitive forecasts of how wet, cold, snowy or stormy this winter will be and we will continue to assess the how the weather will develop through our regular monthly outlooks and shorter-term [forecasts](#).

Date Created

November 2016

Exeter atmospheric scientist wins prestigious award

Description

Adam Scaife, one of our leading scientists and honorary visiting professor at University of Exeter, has been awarded the American Geophysical Union's ASCENT award for research and leadership in atmospheric science. The award recognises Adam who heads the Met Office's long-range forecast research and production of monthly, seasonal and decadal predictions.



Professor Adam Scaife heads the Met Office's long-range forecast research.

Adam has published more than 100 peer-reviewed papers on climate dynamics, improving numerical models and long-range predictions and has led numerous international activities, including his current role as co-chair of the WMO World Climate Research Programme's grand challenge on near-term climate prediction.

Commenting on the award, Adam said: "It's a great honor to receive the AGU ASCENT Award and the acknowledgement that this implies, and I'm truly delighted.

"I'm also indebted to the Met Office for giving me the chance to pursue a career in atmospheric science, which I think it's fair to say is one of the most vibrant areas of terrestrial physics."

The citation for Adam and his response to the AGU can be found [here](#).

Adam's latest research investigates the link between tropical rainfall and our winter weather. Tropical rainfall is much more predictable than the chaotic variations in northern Europe. However, some of this predictability leaks out into the extratropics – the regions lying beyond the tropics. When it rains in the deep tropics this can trigger global-scale waves in the atmosphere that propagate out into the mid latitudes, imparting seasonal predictability of our winter weather. The research paper is now available online at the Royal Meteorological Society's [website](#).

Date Created

November 2016

GOES-R – taking weather observation to new heights

Description

Four decades after the launch of [NOAA](#)'s first weather-observing satellite, meteorologists are excited about the capabilities of the next-generation model – [GOES-R](#) – which is due for launch tomorrow.



Once in geo-stationary orbit, GOES-R will deliver unrivalled information about the weather across the Americas. Image courtesy of NASA

Dr Simon Keogh leads the Met Office's Satellite Data Products and Systems team. He said: "Positioned over 22,000 miles above the Earth, GOES-R will take weather observation to new heights. GOES-R will be in a geo-stationary orbit looking down on the Americas and will provide a detailed view of some of the world's most dramatic weather in near real time." The Advanced Baseline Imager (ABI) on GOES-R will provide updates every few minutes and will provide high-resolution tracking of hurricanes and other rapidly-evolving features.

The imaging systems on GOES-R cover 16 spectral bands, allowing scientists and meteorologists to monitor dust storms, volcanic ash, severe storms and other weather phenomena. Dr Keogh added: "Imaging across so many spectral bands is a significant leap forward from the current GOES monitoring in just five bands, including infrared and visual wavelengths, especially as it provides information that allows us to understand more about atmospheric composition and the presence of

contaminants such as volcanic ash, dust and smoke plumes.”

One of the most exciting aspects of the satellite’s capabilities is the ability to monitor lightning from space. Using the world’s first Geostationary Lightning Mapper (GLM) scientists will be able to gather data on lightning activity over the Americas, boosting the imperfect coverage over the oceans and sparsely-populated areas. Dr Keogh added: “Having a satellite view, rather than relying on ground-based observations, will be a real game changer for those weather and climate scientists who are interested in lightning and the production of nitrogen-oxide gases.”

In a video covering the capabilities of GOES-R, NOAA hopes the GLM will also provide more information about lightning activity in the development of tornadoes, as researchers know that an increase in lightning activity can provide clues about where tornadoes will form.

As well as monitoring the situation on the Earth, GOES-R will also have an updated Space Weather sensor, providing NOAA’s [Space Weather Prediction Centre](#) (SWPC) and the UK [Met Office’s Space Weather Operations Centre](#) (MOSWOC).

Commenting on the anticipated launch, Dr Keogh concluded: “Weather and climate scientists all around the world will breathe a huge sigh of relief once GOES-R is in its geostationary orbit, especially as the satellite had been kept in a location in Florida that was in the path of the devastating Hurricane Matthew.”

Date Created

November 2016

Ice, wind and rain warnings issued

Description

A cold polar [air mass](#) has spread across the UK and is bringing with it a series of [showers](#), mainly across the west. These will be heavy in places, with the risk of hail and thunder.

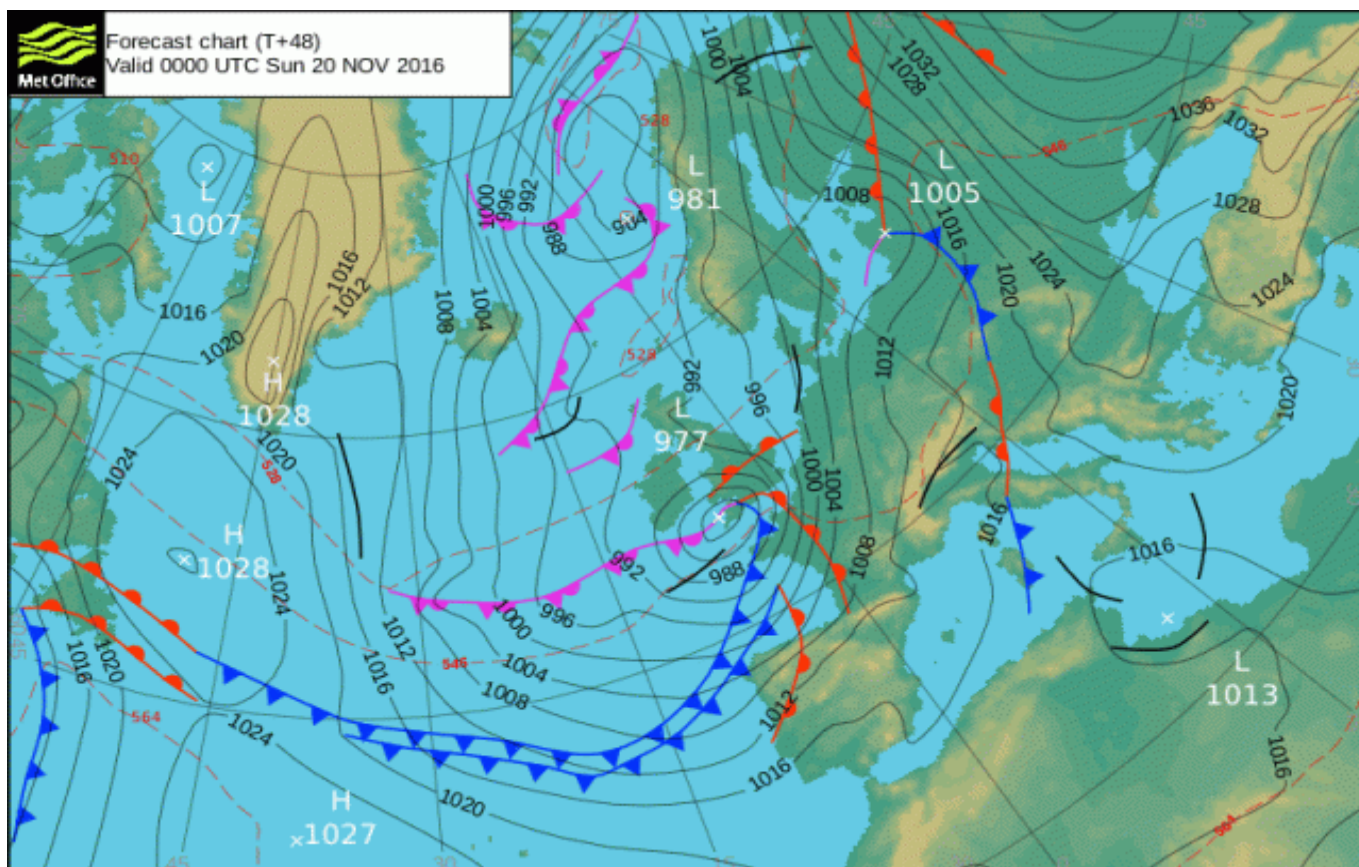
Some showers will fall as snow on higher ground, with 1-3 cm of [snow](#) possible on hills above around 200 m and more than 5 cm above 400 m.

As temperatures fall this evening there is again the chance of ice across the western side of northern England, Wales, Scotland and large parts of Northern Ireland. [A yellow severe weather warning](#) for ice has been issued.



As we move into the weekend we are expecting a vigorous area of low pressure to move northeast across southern Britain on Saturday night and Sunday morning. This will bring heavy rain and southwesterly gales for many. Gusts of 45-55 mph could be felt inland, particularly over Sussex and Kent, with gusts of 60-65 mph possible in exposed south coastal locations.

Up to 20-30 mm of rain could fall within a 6-12 hour period and, although these amounts of rain are not unusual, when combined with gales some localised impacts are expected. Therefore a [yellow severe weather warning](#) for wind and rain has also been issued.



Pressure chart for midnight on Sunday 20 November 2016

Meanwhile there is a chance of some snow on higher levels at the northern edge of this system in Wales and across the south Pennines.

A second system could affect the south on Monday and Tuesday but some north western areas will be drier and colder.

Looking further ahead to mid week, temperatures will remain low with drier weather for many.

Chief forecaster Frank Saunders said: "With lots of varied weather around over the next few days including ice, strong winds and heavy rain, people should take additional care and keep an eye on any warnings and check the website for the latest details in their area."

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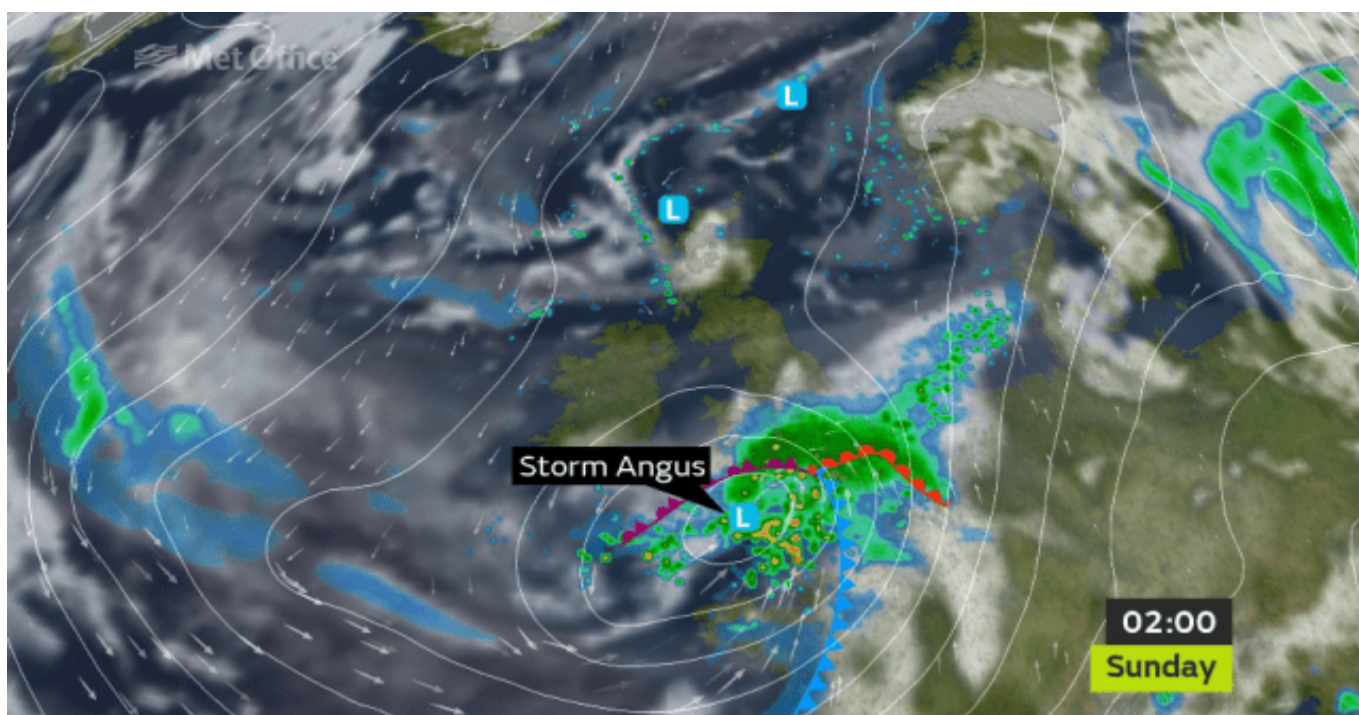
November 2016

Angus the first named storm of autumn 2016

Description

The Met Office has announced the first named storm of autumn 2016: Storm Angus.

Storm Angus is expected to sweep through south-eastern England bringing some very strong south-westerly winds and heavy rain to affected parts through Sunday morning.



Looking at the development of the low-pressure system, on Friday morning the Met Office issued a Yellow warning for Sunday morning for strong winds and heavy rain, from Dorset to Suffolk. But at 10.45am on Saturday Met Office forecasters issued an upgraded Amber warning for severe gales for a stretch of south-eastern England from the Isle of Wight to Kent. The issuing of the Amber warning has triggered the naming of Storm Angus.

- The Amber wind warning is effective from 02:00am on Sunday to 11:00am on Sunday
- The Yellow wind and rain warning is effective from 00:05am on Sunday to 15:00 on Sunday

The Met Office, which is warning that gusts of 70-80 mph are possible in exposed coastal locations within the Amber warning area, is advising there will be likely disruption to transport and power supplies and some damage to buildings.

Met Office Chief Meteorologist, Andy Page, said: “Storm Angus is developing rapidly and will move northeast across southern and southeast England during Sunday morning. Southerly then southwesterly gales are likely with storm force winds developing over the English Channel and affecting some coastal districts. Very squally showers are also expected such that isolated gusts of 70-75 mph are also possible further inland in the Amber warning area.”

Angus is the first named storm of autumn 2016. The Name Our Storms programme is co-ordinated by the Met Office and [Met Éireann](#), the Irish met service. A pilot project began last year, and Storm Angus marks the first storm of the second year of the project.

For more information on preparing for winter, please check the Met Office [Get Ready for Winter](#) pages.

Date Created

November 2016

An expert's view on unusually warm Arctic temperatures

Description

This year has seen some exceptionally low extents of [Arctic sea ice](#) as well as periods of much higher than usual temperatures in the region.

[Ed Blockley](#) manages the Met Office Polar Climate group, whose responsibilities include monitoring the increases and decreases of Arctic sea ice. Commenting on the current state of sea ice he said: "Sea ice extent in the Arctic is at an unprecedented low value, and 2016 has been a notable year in particular."

Throughout the year, the extent of sea ice in the Arctic rises and falls, approximately following the seasons. During March climate scientists expect to witness the greatest extent of Arctic sea ice, the so-called winter maximum, while the corresponding summer minimum occurs during September. Satellite measurements of Arctic sea ice extent have been taken regularly since 1979.

Ed Blockley said: "This March we witnessed the lowest winter maximum on record of 14.52 million square kilometres. This was followed by a mild spring and a record low monthly extent for May. The summer minimum in September wasn't at record-breaking levels but at 4.14 million square kilometres it was notably low, as it was the [joint second lowest year on record after 2012](#)."

Although the September event was noteworthy, it is what has happened since which has been causing concern for scientists. Ed Blockley added: "After the minimum, the extent of sea ice started to increase as more ice began to form. Around 1st October the freeze slowed down considerably and by the third week in October the extent was lower than it was at this point in 2012 – the year with the lowest September minimum on record.

"Since then Arctic sea ice extent has been at unprecedented record low levels for the time of year."

Met Office forecasts over the middle of November show some relatively high temperatures in the Arctic which are supported by those observed temperatures available in the region. In particular on the 16 November we were forecasting temperatures above -5°C over most of the Eurasian Arctic and of over zero Celsius in the Barents Sea as far north as Svalbard. Temperatures this warm in November are up to 20°C above the long-term average.

Commenting on these temperatures, Ed Blockley said: "Daily average temperatures measured at Svalbard airport over October and November have been between around 5 and 13°C above the long-term (1981-2010) average. The daily maximum and minimum temperatures recorded over November have also been higher than normal and have been close to record November highs for about half of the month so far.

“November 2016 has been very warm in Svalbard and as things stand, if the remainder of the month continues to be this warm, then 2016 could very well overtake 2009 to become the warmest November on record there.”

There is quite a lot of daily variability in the temperatures recorded in Svalbard because the air temperatures depend heavily on which direction the wind is coming from and hence whether it passes over sea ice, snow-covered land, or open ocean. At present the sea ice is very low and the ocean surface relatively warm around Svalbard.

Speaking about the impacts of these temperatures on Arctic sea ice, Ed Blockley continued:

“Between 16 and 20 November 2016 the total Arctic sea ice extent actually declined, instead of there being net freezing over the Arctic as would be expected. Although extraordinary this is not unprecedented as a similar, although smaller, reduction in Arctic-wide extent was observed at the start of November 2013. The decline this year resulted from a reduction of the ice cover in the Barents Sea – in the North Atlantic sector – and the Bering/Chukchi Sea – on the Pacific side. This seems to have been caused by relatively warm and moist air being transported into the region from the south.”

Near-surface air temperatures in the Arctic are unusually warm at present, as they have been for the entire autumn. Some forecasting centres have reported observations of up to 20°C warmer than normal. Ed Blockley added: “This will have been partly caused by there being reduced cooling of the atmosphere from the surface because there is less sea ice, meaning that air has more contact with the relatively warm ocean. The sea ice extent is currently at a record low level in the Arctic and the sea surface temperatures are up to 3°C Celsius above normal.

This autumn has seen some rather unusual patterns of atmospheric circulation in the Northern Hemisphere. Persistent southerly winds have brought warmer air northward into the Arctic from both the North Atlantic and across the Bering Straits from the North Pacific.

As well as causing the ice to melt by increasing the surface air temperature, this persistent southerly flow has also acted to push the ice northwards preventing it from advancing to lower latitudes.

Commenting on the future state of Arctic sea ice this season, Ed Blockley added: “This decline is most likely not going to continue, and in fact the most recent observations show ice extent increasing slightly again. Over the whole winter more ice will be formed but this warm spell means that it is possible there will be less ice in the Arctic at the end of winter.”

Looking at longer term trends, September or [summer Arctic sea ice extent has decreased by over 13% per decade](#) since satellite records began in 1979. This is the equivalent to losing an area of sea ice greater than the size of Scotland each year. With this trend in mind, there is widespread speculation about the date when the Arctic will be ice-free in the summer.

Ed Blockley said: “The events happening now don’t mean that the ice will all be gone next year because the rate of melt is highly dependent on the weather conditions that occur in the Arctic in summer. However it will mean that the Arctic sea ice will start the melt season from a disadvantaged position and so would be more susceptible to melt if the conditions are right for it. The latest estimates from the Intergovernmental Panel on Climate Change (IPCC)’s [Fifth Assessment Report \(AR5\)](#) are that we may see the ‘ice-free’ Arctic summer minimum in the 2030s.”

Date Created

November 2016

Winter Outlook for December 2016 to February 2017

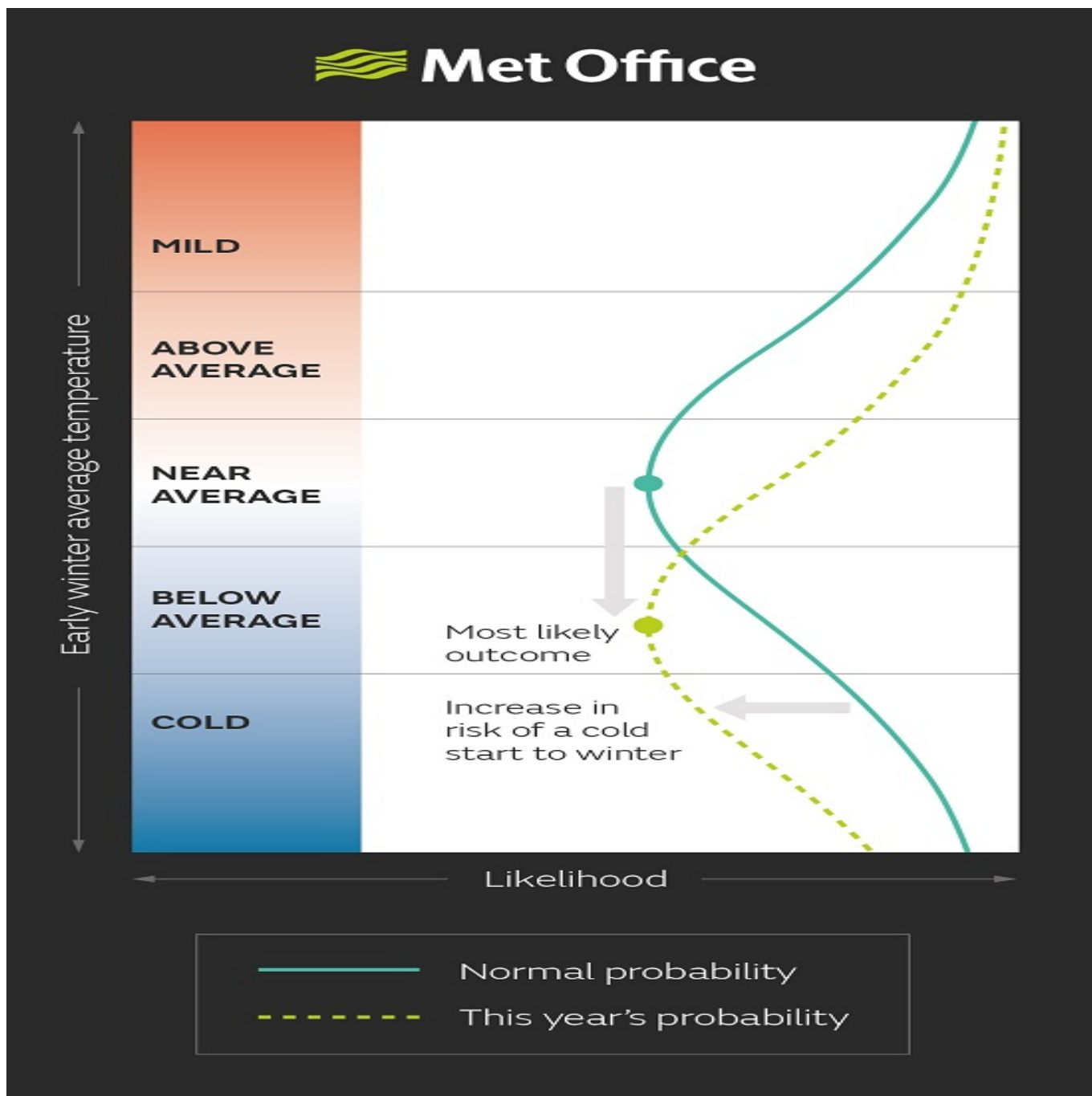
Description

Today the Met Office has released its [long-range outlook](#) for December 2016 to February 2017, highlighting the risk of a cold start to the winter for the UK.

Latest observations from around the globe and long-range weather prediction systems suggest that the early part of the winter period is more likely than usual to be cold. This implies a heightened risk of wintry weather during December and into January.

Overall, it should be stressed that more normal winter weather, with temperatures ranging from slightly below average to mild, is still marginally more likely. Nevertheless, the risk of cold conditions at the start of winter is now greater than it has been in recent winters. More details of specific weather over the coming month is available in the Met Office [30-day and week-ahead forecasts](#).

The graphic below illustrates the current outlook for temperatures in early winter. For a normal year the most likely outcome is in the near average category. This winter, however, the probability is shifted towards below average temperatures, with the most likely outcome – the widest part of the curve – remaining above the ‘cold’ category.



[Doctor Jeff Knight](#), who leads the production of the Met Office [long-range outlook](#) says: “This time last year our outlook gave advance warning of the risk of the [very mild](#), stormy and wet start to winter that was linked to the [flooding in Cumbria](#), but this year indications are very different. Weather patterns with more frequent northerly or easterly winds are favoured, which increases the risk of cold weather.”

Our [winter weather patterns](#) respond to influences from across the globe: Currently, the winds circulating around the North Pole in the [stratosphere](#) – between 10 and 50 km in altitude – are much weaker than normal and this is expected to weaken the westerly winds across the [Atlantic](#).

Furthermore, tropical East Pacific Ocean temperatures are slightly below average, just above the

threshold for [La Nina](#). Although these cool conditions also tend to impede the UK's usual westerly winds in early winter. Warmth in the North Atlantic Ocean near Newfoundland and record low [Arctic sea ice](#) are also contributing to the same tendency, favouring a colder-than-average early winter.

[Professor Adam Scaife](#), head of long-range prediction at the Met Office, explains: "The stratosphere, tropics and Arctic sea ice are all trying to push our weather towards becoming colder over the next few weeks. Although it is not guaranteed, our long range predictions and those from other forecast centres suggest an increased risk of cold weather patterns early this winter."

Later in the winter, there appears to be a shift towards less risk of cold conditions. More detail about this period will be available in updates to the Met Office long-range outlook which will be released as winter progresses and our 30-day and week-ahead forecasts will provide advance warning of specific weather events throughout the winter.

You can keep up to date with the weather using our [forecast](#) pages and by following us on [Twitter](#) and [Facebook](#), as well as using our new [mobile app](#) which is available for iPhone from the [App store](#) and for Android from the [Google Play store](#).

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November 2016

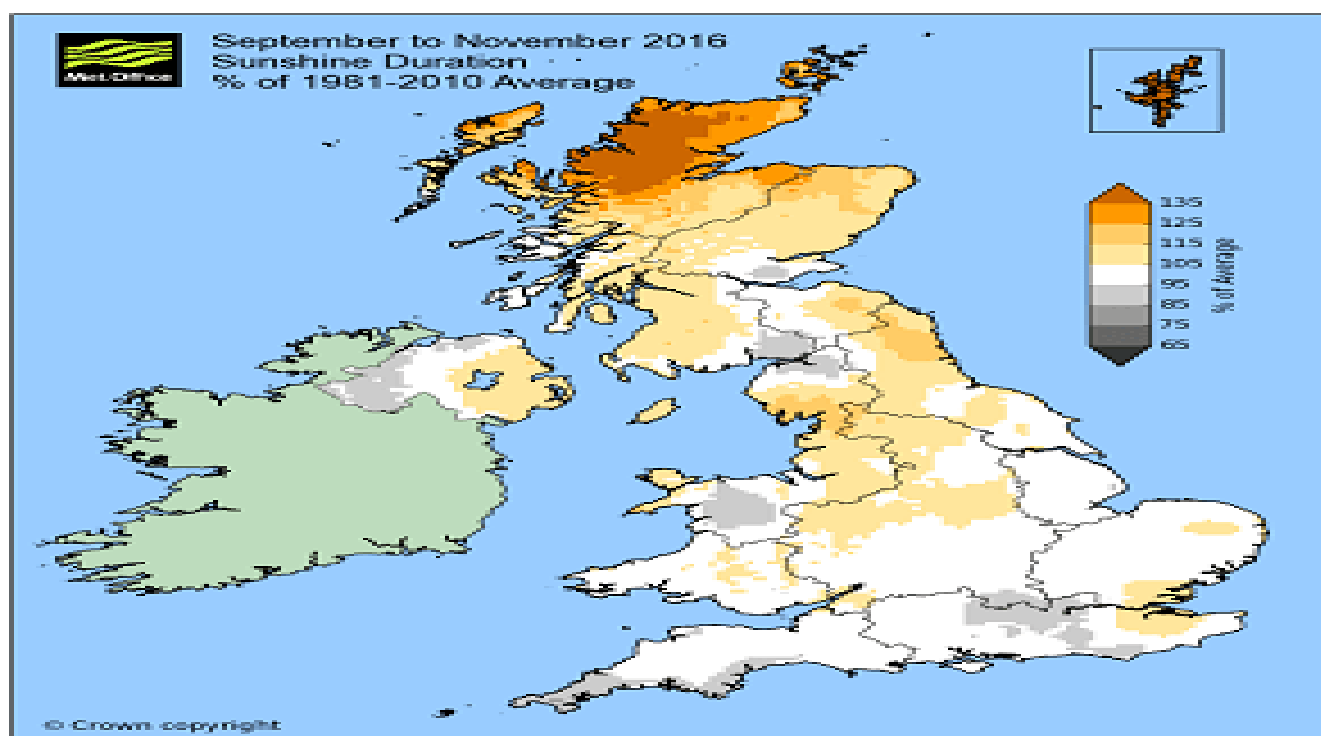
Autumn and November 2016 statistics

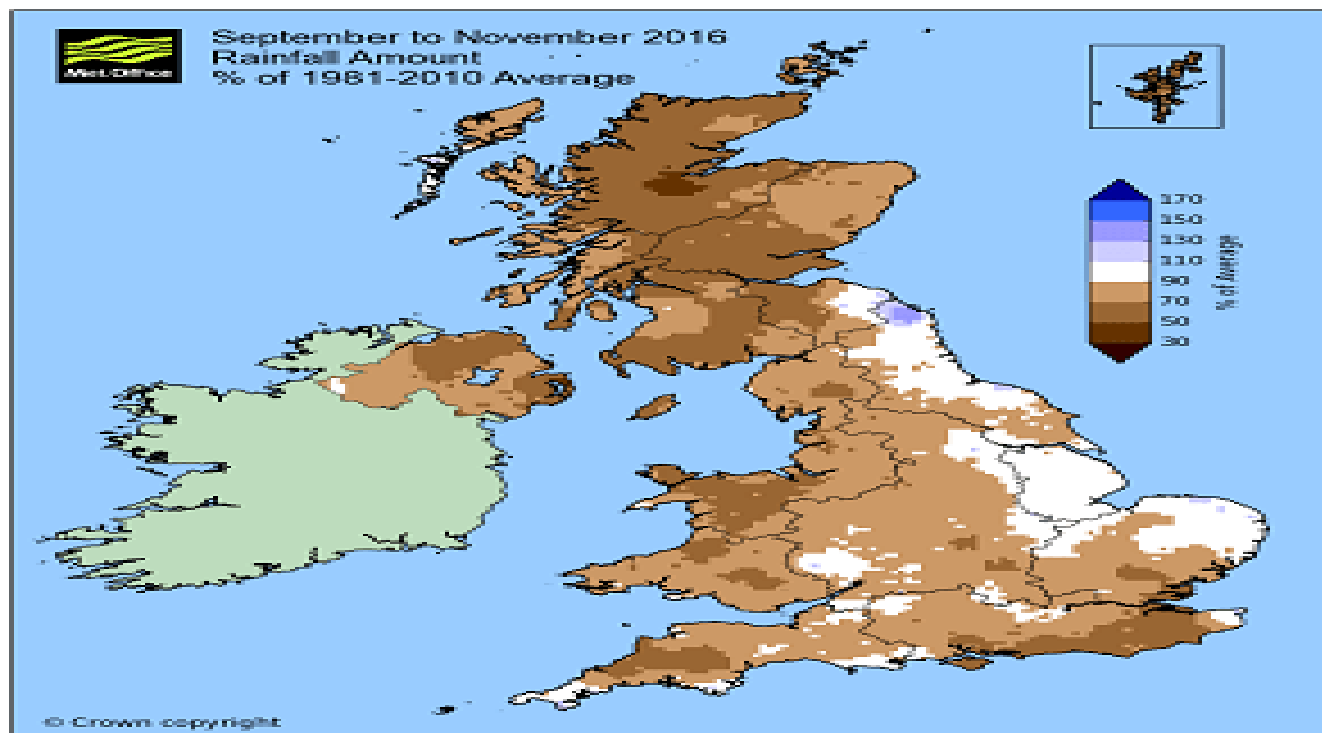
Description

We've seen a wide variety of weather this autumn from the warmest day of the year to snow; although early statistics (1 September – 30 November) show overall has been a fairly average season.

Despite [September](#) proving to be the equal-second warmest for the UK since records began (1910) and the warmest day of the year at 34.4°C being recorded on 13th September in Gravesend, autumn temperatures have only been slightly above average for the UK as a whole. The notably warm September has been partially offset by a cold November and lower temperatures are likely to continue to the end of the month.

It's been a slightly drier autumn than average, despite some periods of heavy rain mainly due to a series of low pressure systems in November. The UK as a whole has so far had around three quarters of expected rainfall, with Scotland seeing 67% of its average while East and North East England seeing close to their long term average with 94%.





Northern Scotland looks like it will have had its third sunniest autumn on record (dating back to 1929). However overall the preliminary autumn figures show all areas, aside from southern England, have had slightly above average sunshine hours.

Autumn 2016

(1 Sept – 30 Nov)

Sunshine hours

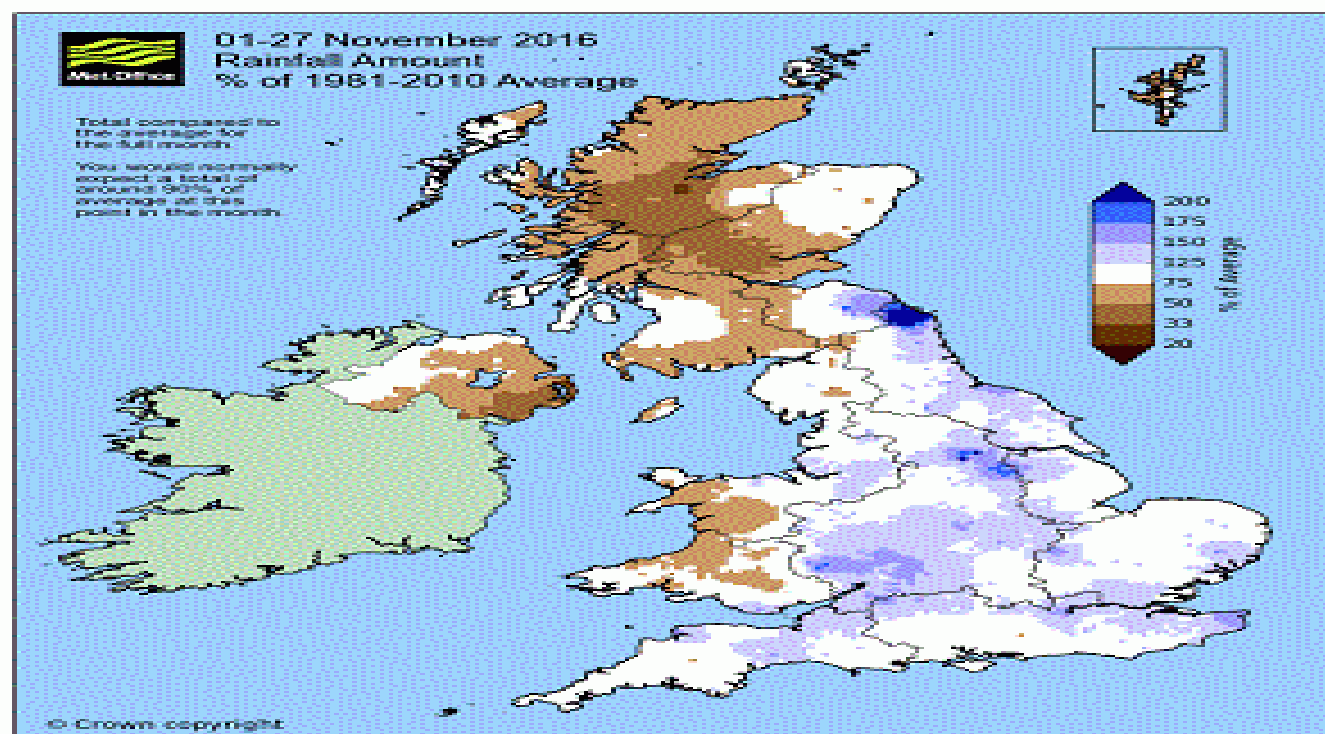
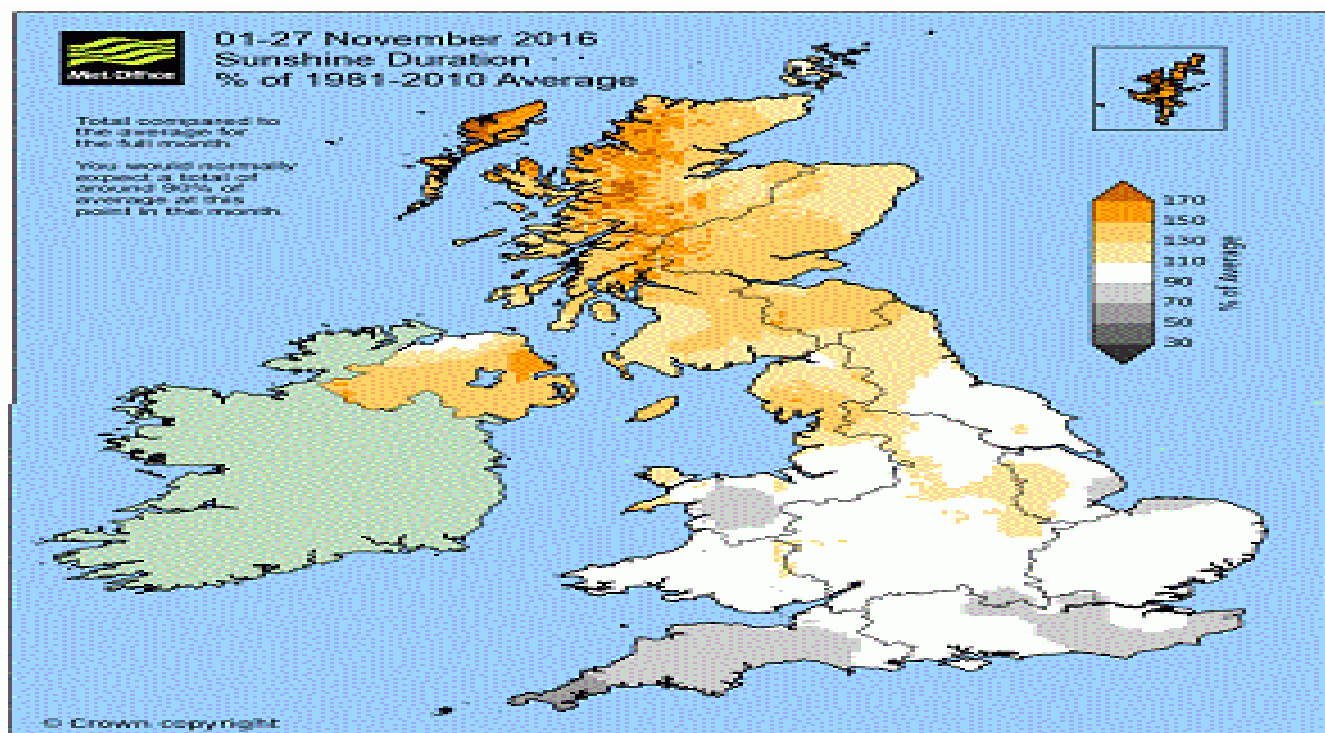
Mean Temperature

	Actual	hours	% diff from average	Actual °C	°C diff from average
UK	300.9		110	9.8	0.3
England	328.2		108	10.7	0.4
Wales	297.4		107	10.1	0.2
Scotland	263.1		116	8.2	0.2
N Ireland	262.6		103	9.5	0.1

November

It's been rather a cold November, with temperatures widely around a degree or so below the 1981-2010 average. Scotland had the largest deviation from the average with mean temperatures -1.6°C lower than the 4.9°C long term average. Scotland has also had its sunniest November since records began in 1929 with 65.8 hours of sunshine.

Northern Ireland's lowest recorded temperature of the year so far was recorded this month with -7.5°C at Katesbridge on 24 November. The third lowest temperature for the UK as a whole, -12.1°C , was recorded at Braemar on 21 November.



As well as cold settled conditions, November also had the first named storm of the year with [Storm Angus](#) impacting large parts of Southern England and Wales. Strong wind and heavy rain affected these areas from 17 to 22 November due to a series of low pressure systems. The strongest wind gust

recorded was 80 mph at Langdon Bay in Kent on 20 November, while Exeter saw 108.6mm of rain between 19 and 22 November, nearly 80% of the average rainfall expected for Devon in November.

However, despite spells of heavy rain, the month has been on the dry side for many with the UK as a whole having had 89% of expected average rainfall to date, and Northern Scotland just 63%. Meanwhile the Midlands have seen 28% more than the average for November.

November 2016 (Provisional)

November 2016 (Provisional)	Sunshine hours		Rainfall		
	Actual	hours	% diff from average	Actual mm	% diff from average
UK	74.6		130	107.9	89
England	80.3		124	103.5	117
Wales	71.3		126	133.4	82
Scotland	65.8		144	113.1	68
N Ireland	76.4		142	87.0	72

The sun has been shining for many with the UK having 30% above average sunshine hours, and Northern Ireland topping the regions long term average by 42%.

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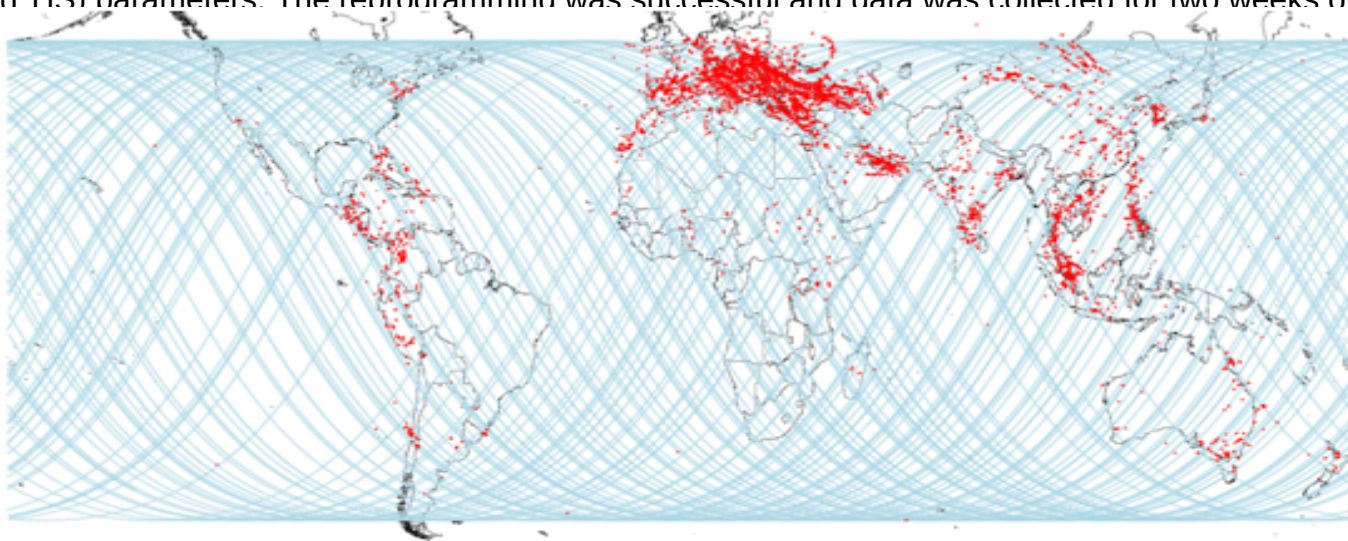
Can space tech help measure the weather?

Description

This summer the Met Office was able to take advantage of a nanosatellite being used as a technology demonstrator by the European Space Agency (ESA) to gather weather information. The satellite, GomX-3, was built by the Danish CubeSat developer GomSpace. Using technology not tested in this way before, our scientists were able to use this satellite to gather wind and temperature [observations](#) over a large part of the globe.

The data was collected from messages sent routinely from aircraft back to Air Traffic Control. This experiment has proven that by exploiting existing technology in new ways it is possible to obtain weather data for locations which may be data sparse. In the future this data could be fed into numerical weather models to help improve the accuracy of weather forecasts.

The ESA technology demonstrator, GomX-3, was designed to collect Automatic Data Surveillance – Broadcast (ADS-B) messages to track aircraft from space using a nanosatellite. Collaboratively GomSpace, ESA and the Met Office agreed on an extended mission which would involve reprogramming GomX-3 whilst it was in orbit around the Earth to collect additional parameters required to calculate wind and temperature observations. These are called Mode-S Enhanced Surveillance (EHS) parameters. The reprogramming was successful and data was collected for two weeks over a



The

Met Office has been investigating this aircraft derived data method since 2011. Mode-S EHS is used by Air Traffic Management to obtain situation information from aircraft. This data combined with the position ADS-B data allows wind and temperature to be calculated at the location of the aircraft. There are currently 6 ground based receivers located throughout the UK and Channel Islands collecting the data and deriving up to 6.8 million observations of wind and temperature per day from aircraft in flight

across UK airspace. This is an increase from just 10000 aircraft observations over the UK per day!

A large part of the work over the last 5 years has been around understanding the quality of the observations. Comparisons to our high resolution operational model have been conducted on every model run since 2013. We've also made use of the [Facility for Airborne Atmospheric Measurements](#) and compared the observations to those made by the research grade instrumentation on the aircraft. The quality of the wind observations has been found to be comparable to more traditionally sourced aircraft data, while the temperature information requires some additional manipulation.

The increasing number of observations is important to drive the mathematical models used in weather forecasting. The resolution of the models is ever increasing; over the UK the Met Office now uses a model with a grid spacing of 1.5km, everyday this model uses around 250,000 upper air wind observations. This data is used to nudge the model of the atmosphere closer to what is being measured, ultimately leading to improvements in the forecast. To keep pace with improvements in models, novel methods of gathering observations must be used like those explored in this mission.

Edmund Stone, Observation Scientist at the Met Office said: "This information will be useful in the future in increasing the global observation network coverage, both from the ground and also from orbit. The project has also shown that it is feasible to use small, relatively low cost satellites for the collection of data for atmospheric measurement".

These results have changed our view of data availability, demonstrating that there is Mode-S EHS/ADS-B data available from significant areas, including data from every continent (excluding Antarctica). It is estimated that there is in excess of 100,000,000 observations available globally each day that are currently not being collected or used by the meteorology community. The challenge now comes in trying to harness this resource.

Date Created

November 2016